INSTRUMENT READINESS PLAN (IRP)

FOR THE

NSLS–II 2-ID (SIX) BEAMLINE

NOVEMBER 2016

NSLSII-2ID-PLN-002

PREPARED BY

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FOR THE

U.S. DEPARTMENT OF ENERGY
OFFICE OF SCIENCE BASIC ENERGY SCIENCE
UNDER CONTRACT DE–SC0012704

BROOKHAVEN
NATIONAL LABORATORY

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REVIEWED BY:

A. Ackerman, Instrument Readiness Coordinator

APPROVED AS A PLAN TO ACHIEVE READINESS BY:

Steven L. Hulbert 21-October-2016

S. Hulbert, IRR Technical Authority

CONCURRENCE BY:

Robert M. Lee 10/21/16

R. Lee, ESH Manager

APPROVED – IRP HAS BEEN FULLY IMPLEMENTED AND INSTRUMENT IS READY FOR COMMISSIONING:

Steven L. Hulbert 14-February 2017

S. Hulbert, IRR Technical Authority

CONCURRENCE BY:

Robert M. Lee 2-14-17

R. Lee, ESH Manager

BROOKHAVEN NATIONAL LABORATORY

REVISION HISTORY

VERSION	DESCRIPTION	LIST OF REVIEWERS	DATE
1	Initial Issue	See completed tables	November 2016

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ATTACHMENTS

1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of this Instrument Readiness Plan (IRP) is to establish the readiness criteria required to declare the NSLS-II 2-ID (Soft Inelastic X-ray Scattering [SIX]) Beamline ready for commissioning. The scope of this IRP includes the 2-ID Beamline, and was prepared in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). The Front End (FE) and Insertion Device (ID) for this beamline were evaluated in a previous IRR on October 19, 2016.

The scope of this IRR is divided as follows, into 2 phases:

Phase 1 includes planning, design and installation of all beamline systems on the experimental floor side of the accelerator enclosure sawtooth with the following exceptions:

- Beamline PPS
- Front End EPS
- Front End PPS

Final systems testing and certification will not be complete. Completion of this phase of the IRP will not result in a request for authorization to operate with the photon beam.

Phase 2 includes testing and certification for the PPS and EPS as well as personnel readiness for all remaining systems/readiness criteria needed to begin commissioning of the SIX instrument from source to endstation. At the completion of this phase of the IRR, a request for authorization to proceed with technical commissioning will be submitted in accordance with NSLS II policy and procedure.

This IRP will be used as a tool for planning and certifying readiness. The completion of this IRP will proceed in the two phases describes and will require that the listed actions and documentation are complete.

1.2 2-ID Beamline

The 2-ID Beamline is an elliptically polarizing undulator (EPU) beamline at NSLS II which will provide resonant inelastic x-ray scattering capabilities for studies of the electronic structure of quantum materials of interest to physics and materials science communities. The fan size from the front end is 0.3 mrad x 0.3 mrad (V x H), and the beamlime fan size is 0.2 mrad x 0.2 mrad (V x H). The ID source delivers beam to a side-bouncing plane mirror located in the First Optical Enclosure (FOE, Hutch 2-ID-A). This mirror is the first optical system for the beamline, and acts as a high-energy cut off. A differential vacuum pumping system located in the FOE separates the accelerator vacuum from the beamline vacuum. The pink beam of energy < 2200 eV is delivered to the pre-mirror in the plane grating monochromator (PGM), located on the experimental floor outside the FOE. The pre-mirror deflects the beam vertically towards the grating, also located inside the PGM tank. The grating focuses the beam vertically onto the exit slit, which is located on the experimental floor of the satellite building SEB2. The beam at the exit slit is focused horizontally by the M3 mirror, which is also located on the experimental floor of SEB2. A monochromatic beam in the energy

range of 165-2200 eV is delivered by the exit slit to the refocusing mirror M4, which focuses the beam in both horizontal and vertical directions at the sample spot. The credited controls include shielding, an area radiation monitor (ARM), and personnel protection system (PPS) interlocks, in accordance with the *NSLS-II Accelerator Safety Envelope (ASE)* (PS-C-ESH-ROASE-001).

1.3 Instrument Readiness Review (IRR)

As part of the verification of readiness for commissioning, an IRR is required in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). An independent IRR Team will use the readiness criteria developed as part of this IRP to verify that the 2-ID Beamline is ready for commissioning in accordance with the appropriate Commissioning Plan. Pre-start and post-start findings will be identified by the team.

1.4 Authorization to Proceed with Commissioning

The completion of this IRP, together with closure of any pre-start findings from the IRR, is used as the basis for the NSLS-II Director to authorize the start of commissioning of the 2-ID Beamline.

2.0 Instrument Readiness Plan

2.1 Readiness Criteria

Readiness criteria are provided in Attachments A through D. The criteria were developed by the Instrument Readiness Coordinator (IRC) and Readiness Team members, using the *General Readiness Criteria* provided in Attachment A and the *Instrument Readiness Guide* provided in Attachment C of the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001).

The readiness criteria are grouped into the following categories:

- Pillar I – Documentation
- Pillar II – Hardware
- Pillar III – Personnel
- Completion of IRR Pre–Start Findings

3.0 IRP Implementation

3.1 Readiness Team

A Readiness Team will be appointed by the NSLS-II Director in accordance with the *Instrument Readiness Review Procedure* (PS-C-ESH-PRC-001). The Readiness Team members that have responsibility for completing the IRP are listed as the Responsible Person in the Attachments.

3.2 Achieving Readiness – Responsibilities

The Readiness Team members are responsible for ensuring that their specific readiness criteria are achieved.

The Lead Beamline Scientist is responsible for certifying that all of the readiness criteria associated with the Beamline is achieved.

3.3 Execution of the IRP

The Readiness Team members shall execute this IRP by preparing, installing, documenting, or training (as appropriate), the specific scope of work (readiness criteria) assigned to them as listed in the Attachments. The Readiness Team members shall develop, compile or assemble the documented evidence that clearly demonstrates that the readiness criteria have been met. This evidence shall be listed on the Attachments.

3.4 Certifying Readiness

Upon completion of the readiness criteria, the Readiness Team members will certify that the criteria for which they are responsible for are complete by signing the Attachments in the appropriate section. The Attachments shall not be signed until the readiness criteria have been fully achieved.

For completion of the IRR pre-start findings, if identified, the IRR Technical Authorities and the ESH Manager will certify that all IRR pre-start findings relative to the 2-ID Beamline have been completed, and that the associated ATS Actions have been closed by signing Attachment D in the appropriate section. The Independent Verifier will concur that these actions have been adequately completed and closed by signing Attachment D in the appropriate section.

4.0 REFERENCES

4.1 PS-C-ESH-PRC-001, *Instrument Readiness Review Procedure*

4.2 PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*

ATTACHMENT A – PILLAR I DOCUMENTATION

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Functional Description** An overview presentation is prepared that defines the scope of the IRR and includes the following Beamline specific information: – Primary capabilities – Physical layout and location (includes Beamline location on the experiment floor) – Design reviews and performance parameters – Source characteristics – Photon beam performance goals – Radiation Safety Committee reviews – Self-identified pre-start findings – Description and status for each item listed in this Instrument Readiness Plan	I. Jarrige Lead Beamline Scientist	• Develop the presentation described for the Beamline	• Presentation • Functional Description Document	Signature:
	Beamline Design Beamline components are designed in accordance with PS-QAP-0412, *Design Reviews* and PS-C-QAS-PRC-010, *Engineering Design by Others*.	I. Jarrige Lead Beamline Scientist	• Complete Engineering Design Reviews for the Beamline, FE and ID that address thermal management, mechanical support, configuration control, and vacuum	Beamline: • Internal and contractor supplied design review documents and reports	Signature:
	Radiation Safety Components Design Radiation Safety Components for the Beamline and FE designed in accordance with NSLS-II requirements, PS-QAP-0412, *Design Reviews* and PS-C-QAS-PRC-010, *Engineering Design by Others*.	I. Jarrige Lead Beamline Scientist	• Complete requirements analysis and design of radiation safety components for the Beamline	• Internal design review documents and reports • RSC Report	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Top-Off Safety System (TOSS)** FE has been analyzed for Top-Off Safety in accordance with PS-C-ASD-PRC-183, *Approval of New and Modified NSLS-II Beamline Front Ends for Top Off Safety.*	R. Fliller Coordinator for Top Off Safety	• Complete TOSS analysis	• TOSS Analysis Report • Updated FE layout drawings • Updated *Beamlines Approved for Top-Off Operations* list	Signature:
	Ray Traces Bremsstrahlung and Synchrotron Ray Traces generated in accordance with PS-C-XFD-PRC-008, *Synchrotron and Bremsstrahlung Ray Trace Procedure.*	I. Jarrige Lead Beamline Scientist	• Prepare the Ray Traces for the Beamline	• Approved Primary Bremsstrahlung Ray Traces • Approved Maximum Synchrotron Ray Traces	Signature:
	Secondary Radiation Scatter Analysis Secondary Bremsstrahlung and Synchrotron scatter is analyzed in accordance with LT-C-ESH-STD-001, *Guidelines for the NSLS-II Beamline Radiation Shielding Design.*	M. Benmerrouche Health Physics	• Complete FLUKA analysis • Complete STAC8 analysis	• BNL Technical Note Report	Signature:
	National Environmental Protection Act (NEPA) Evaluation NEPA requirements evaluation completed.	L. Stiegler ESH Operations Group Leader	• Complete a NEPA evaluation	• NEPA Evaluation Report	Signature:

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ATTACHMENT A – PILLAR I DOCUMENTATION

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Unreviewed Safety Issue (USI) Evaluations/ Screenings** Authorization basis hazard identification is managed through USI evaluation/screening.	S. Moss Authorization Basis Manager	• Verify that the SAD and ASE accurately cover the hazards associated with the subject Beamline, FE and ID; including temporary systems	• SAD and ASE USI screenings/evaluations • Applicable waivers	Signature: 01/17/17
	Resolution of Open Action Tracking System (ATS) Actions Instrument specific action items from previous internal and external oversight groups (e.g., RSC, Design Reviews, etc.) are addressed. Previous IRR action items are addressed.	J. Zipper QA Engineer	• ATS action items for the instrument are satisfied. • ATS action items from previous IRRs are evaluated for impact to the instrument	• ATS System	Signature: 2/14/17

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT A – PILLAR I DOCUMENTATION

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Procedures** Procedures needed for safe, secure, and environmentally sound commissioning have been developed, reviewed, validated (where applicable), and approved. Existing procedures are verified as sufficient for new hazards introduced by this Beamline, if any.	K. Rubino Procedure Support	• Develop any system specific procedures • Verify that existing procedure are sufficient for any new hazards introduced	• 2-ID Radiological Interlock Test Checklist • Search and Secure Sketch	Signature: 
	Commissioning Plan Commissioning plans have been generated for the Beamline and FEs and IDs to address the task sequence required for technical commissioning (safe photon transport).	I. Jarrige Lead Beamline Scientist	• Prepare a Beamline Commissioning Plan to define technical objectives and operational readiness requirements	• Approved Beamline Commissioning Plan	Signature: 
	Radiation Survey Procedure A survey procedure has been generated for the Beamline in accordance with PS-C-XFD-PRC-004, *NSLS-II Beamlines Radiation Safety Commissioning Plan*.	M. Benmerrouche Radiation Physicist	• Prepare the Radiation Survey Procedure for the Beamline	• Approved Beamline Radiation Survey Procedure	Signature: 

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ATTACHMENT A – PILLAR I DOCUMENTATION

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR I DOCUMENTATION (PLANNING & PROCEDURES)	**Proposal Allocation Safety & Scheduling (PASS)** The instrument is active within PASS with approvals to proceed with Technical Commissioning.	I. Jarrige Lead Beamline Scientist	• Assure that PASS is configured to administer the instrument	• Defined resource within PASS • Submitted Technical commissioning proposal • Submitted Safety Approval Form	Signature: 

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ATTACHMENT B – PILLAR II HARDWARE

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Radiation Safety Components: Installation** Radiation Safety Components, including Top Off components are installed in accordance with the Traveler.	I. Jarrige Lead Beamline Scientist	• Generate and execute Traveler	Beamline: • Completed Traveler	Signature:
		L. Doom Accelerator Coordination	• Generate and execute Top-Off Traveler	• Completed Traveler	Signature:
	Radiation Safety Components: Configuration Control A Radiation Safety Component Checklist template is generated in accordance with PS-C-ESH-PRC-025, *NSLS-II Radiation Safety Component Inspection Procedure.*	I. Jarrige Lead Beamline Scientist	• Develop Radiation Safety Component Checklist	• Approved beamline specific Radiation Safety Component Checklist	Signature:
	Area Radiation Monitors (ARMs) ARMs are installed in accordance with PS-C-ESH-ARN-SPC-001, *NSLS-II Area Radiation Monitor (ARM) System Description* and PS-C-ESH-STD-002, *Technical Basis Document for Interlocked Area Monitors Placement Outside the Accelerator and Beamlines Enclosures.*	M. Benmerrouche ARM Technical Authority	• Install, calibrate, and test (EPICS integration) ARMs • Certify (PPS)	• ARM Layout Drawing • ARM calibration certificates • ARM EPICS Interface Integration Test Sheet • ARM PPS Test checklist	Signature:
	Personnel Protection System (PPS) Interlocks: Installed and Certified Hardware/Software installed in accordance with PS-C-XFD-SPC-PPS-001, *Beamline Personnel Protection System (BLPPS)*	G. Ganetis Electrical Engineering Group Leader	• Generate system schematics and logic diagrams • Install PPS components • Certify PPS	• Overall PPS Checklist • Executed Beamline Radiological Interlock Certification Checklist	Signature:

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ATTACHMENT B – PILLAR II HARDWARE

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II SAFETY CRITICAL HARDWARE (INSTALLATION)	**Hutch Structures** Hutch structures installed with adequate provision for life safety issues (egress and fall protection) in accordance with NX-C-XFD-SOW-HU-002, "*NSLS-II Steel Beamline Shielding Enclosures Statement of Work*" and NX-C-XFD-SPC-HU-002, "*NSLS-II Steel Beamline Shielding Enclosures Technical Specifications.*"	E. Haas Beamline Engineer	• Generate and execute Traveler for inspection	• Completed Traveler	Signature: Edwin Haas 10/26/2016
	Electrical Power SBMS electrical power distribution requirements are satisfied. SBMS Electrical Equipment Inspection (EEI) requirements are satisfied.	A. Boerner Electrical Distribution Engineer	• Generate and approve one-line drawings • Complete system electrical inspection • Complete needed EEI inspections	• Approved AC Power one–line drawings • EEI database entries	Signature: 11/7/16
	Utilities Permanent utility systems are installed and tested (i.e., Compressed Air, DI Water, Gaseous Nitrogen, Process Chilled Water) in accordance with design drawings.	J. Gosman Mechanical Utilities Group Leader	• Generate system schematics • Perform pressure test	• Approved system schematics • System pressure testing reports	Signature: 11/7/16

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ATTACHMENT B – PILLAR II HARDWARE

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	**Other Photon Transport Components, Optics, and Diagnostics** FE and photon transport components that are not radiation safety components are installed and tested in accordance with the Travelers. Diagnostic equipment needed to begin technical commissioning is installed and tested.	I. Jarrige Lead Beamline Scientist	• Generate and execute Traveler • Complete acceptance inspections	Beamline: • Completed Traveler • Acceptance inspection documentation, as needed	Signature:
	Beamline Equipment Protection System (EPS) Interlocks Hardware/Software installed and tested in accordance with the Traveler.	R. Kadyrov Controls Infrastructure Group Leader	• Generate and execute Traveler • Verify EPICS integration • Test system performance	Beamline: • Completed Traveler	Signature:
	Front End Equipment Protection System (FEEPS) (Phase 2 Installation needed for beamline operation) Hardware/Software installed and tested in accordance with the traveler.	G. Ganetis Electrical Engineering Group Leader	• Verify integration • Test system performance	• Test Report Phase 2 Installation	Signature:
	Controls Hardware/Software installed and tested in accordance with NSLS-II requirements.	J. Ma Controls Group Engineer	• Test system performance • Complete integral testing	• Performance and integral testing documentation	Signature:

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT B – PILLAR II HARDWARE

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR II OTHER HARDWARE (INSTALLATION)	**Vacuum** Vacuum hardware has been installed and tested in accordance with the Traveler and has the capability of achieving full vacuum needed during commissioning.	R. Todd Vacuum Engineer	• Generate and execute Top Level Traveler • Identify overpressure devices • Test system performance	Beamline: • Completed Top Level Traveler • Test Report	Signature: 

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT C – PILLAR III PERSONNEL

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	ACTIONS	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
PILLAR III PERSONNEL	**Lead Beamline Scientist (LBS) / Cognizant Space Manager (CSM)** LBS and CSM personnel are assigned and Trained/Qualified.	B. Lein Training Group Leader	• Assign JTA for LBS and CSM	• BTMS record	Signature: Bruce Lein
	Authorized Beamline Staff Sufficient personnel to begin commissioning are assigned and Trained/Qualified.	B. Lein Training Group Leader	• Assign JTA	• BTMS record	Signature: Bruce Lein
	Support Staff Other, non-beamline dedicated personnel needed to begin commissioning (e.g., Beamline Engineers and Controls Personnel) are assigned and Trained/Qualified for the Beamline and FE/ID.	B. Lein Training Group Leader	• Assign JTA	• BTMS record	Signature: Bruce Lein
	Lead Operators, Scientific Operators & FLOCOS (Accelerator Division) Trained/Qualified to: – Execute the Beamline Enable procedure – Perform roles assigned in any Beamline-specific procedures – Perform tasks related to FE and ID commissioning	B. Lein Training Group Leader	• Train Operators	• BTMS record	Signature: Bruce Lein

* READINESS CERTIFICATION	I. Jarrige, Lead Beamline Scientist	Signature: Jarrige

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.

ATTACHMENT D – COMPLETION OF IRR PRE–START FINDINGS

2-ID BEAMLINE

	READINESS CRITERIA	RESPONSIBLE PERSON	DOCUMENTED EVIDENCE	CERTIFICATION OF READINESS*
IRR PRE–START FINDINGS	**Actions Complete** All actions associated with the 2-ID Beamline pre-start findings are completed and the ATS Actions are closed.	S. Hulbert IRR Technical Authority	• ATS	Signature:
	Actions Closed All actions associated with the 2-ID Beamline IRR pre-start findings have been verified complete and the ATS Condition is closed. (ATS Condition No. _____)	R. Lee ESH Manager	Beamline: • ATS	Signature:
	Actions Verified Actions associated with the 2-ID Beamline IRR pre-start findings have been satisfactorily completed.	M. Hauptmann Independent Verifier	Beamline: • ATS	Signature:
	No Pre-Start Findings Identified No pre-start findings have been identified by the Review Team and therefore the previous lines do not require sign-off.	R. Lee ESH Manager	• IRR Preliminary Report	Signature:
		M. Hauptmann Independent Verifier	• IRR Preliminary Report	Signature:

– END –

*Signature certifies that the readiness criteria are met. The Responsible Person shall not sign prior to completion.